

Article

Antimicrobial Effects of Basil, Summer Savory and Tarragon Lyophilized Extracts in Cold Storage Sausages

Artur Macari ^{1,*}, Rodica Sturza ^{1,*}, Ildiko Lung ^{2,*}, Maria-Loredana Soran ², Ocsana Opris ², Greta Balan ³, Aliona Ghendov-Mosanu ¹, Dan Cristian Vodnar ⁴ and Daniela Cojocari ³

¹ Faculty of Food Technology, Technical University of Moldova, 9/9 Studentilor Street, MD-2045 Chisinau, Moldova; artur.macari@tpa.utm.md (A.M.); aliona.mosanu@tpa.utm.md (A.G.-M.)

² National Institute for Research and Development of Isotopic and Molecular Technologies, 400293 Cluj-Napoca, Romania; loredana.soran@itim-cj.ro (M.-L.S.); ocsana.opris@itim-cj.ro (O.O.)

³ Department of Preventive Medicine, "Nicolae Testemitanu State" University of Medicine and Pharmacy, 165 Stefan cel Mare Bd., MD-2004 Chisinau, Moldova; greta.balan@usmf.md (G.B.); daniela.cojocari@usmf.md (D.C.)

⁴ Faculty of Food Science and Technology, University of Agricultural Sciences and Veterinary Medicine, 3-5 Manăstur Street, 400372 Cluj-Napoca, Romania; dan.vodnar@usamvcluj.ro

* Correspondence: rodica.sturza@chim.utm.md (R.S.); ildiko.lung@itim-cj.ro (I.L.)

Abstract: The problem of functional foods with bioactive components of natural origin is current for the food industry. Plant extracts rich in polyphenols with antioxidant and antimicrobial activity are a promising source for use in improving the quality and characteristics of fresh meat and meat products. In this context, the purpose of the present study was to evaluate the physico-chemical, microbiological, sensory properties of sausages prepared with the addition of lyophilized extract of basil, thyme or tarragon. For the beginning, the total amount of polyphenols, the antioxidant and antimicrobial activity of the extracts obtained from three spices were evaluated. In the sausages previously infected with *Staphylococcus aureus* and *Escherichia coli* it was observed that there is a much larger number of colonies of microorganisms in the control sample compared to the other samples within 24 and 48 h. Moreover, following the addition of sausage extracts, no changes were found regarding their sensory acceptability.

Keywords: aromatic plants; extracts; antimicrobial activity; sausages; quality



Citation: Macari, A.; Sturza, R.; Lung, I.; Soran, M.-L.; Opris, O.; Balan, G.; Ghendov-Mosanu, A.; Vodnar, D.C.; Cojocari, D. Antimicrobial Effects of Basil, Summer Savory and Tarragon Lyophilized Extracts in Cold Storage Sausages. *Molecules* **2021**, *26*, 6678. <https://doi.org/10.3390/molecules26216678>

Academic Editor: Changsheng Zhang

Received: 30 September 2021

Accepted: 1 November 2021

Published: 4 November 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The functional foods are considered to be those foods that are intended to be consumed as part of the normal diet and that contain additional biologically active components that offer the potential for increased health or reduced risk of disease [1].

The interest for this category of food products has increased and the aim is to develop standards and guidelines for the development and promotion of such foods. Consumer interest in the relationship between food and health has grown substantially in Europe. There is a much broader recognition that today people can reduce the risk of disease and maintain their health and well-being through a healthy lifestyle, including diet.

The important role of foods such as fruits, vegetables, and whole grains in disease prevention, as well as the latest research on dietary antioxidants and combinations of plant protection substances, has provided an impulse for the development of the functional food market [2].

The use of plant extracts as a source of bioactive compounds is becoming an attractive strategy for improving the quality and characteristics of fresh meat and meat products [3]. Indeed, given their natural origins, bioactive compounds obtained from plants are ideal candidates to replace synthetic antioxidants (generally considered less safe) and to increase the shelf life of meat products. At the same time, these plant extracts can improve, either directly or indirectly, the functional value of meat products [4].

Antimicrobial compounds are used to inhibit the growth of microorganisms that induce food spoilage and antioxidants to retard lipid oxidation and discolouration of food [5,6]. Without food additives, adverse effects may be expected, such as more product recalls, an increased number of food-borne illness and subsequently increased the amount of food waste. Food producers therefore experience a severe limitation on the number of useful additives available. It is not possible to remove all preservatives without serious consequences on product safety and quality, but for the harmful effects of these compounds on humans, it is preferable to use the minimum quantities necessary for food preservation or changes with natural compounds. The challenge for clean label products is to find new food additives that meet both the food industry demand of having antioxidant and antimicrobial potency as well as consumer's demand of being natural without compromising sustainability [7].

The meat industry is an extremely important food sector in European countries and provides a nutritionally dense food that contains a wide range of nutrients such as proteins, lipids, vitamins and minerals. The meat sector has faced years of frequent crisis concerning safety, quality and negative publicity. It is therefore important to contribute to an increase in the confidence for meat as a healthy food choice. The microbial spoilage of minced meat products is a heterogeneous process that involves the development of diverse and poorly characterised microbial communities. Despite the fact that bacterial growth is one of the main factors that makes meat objectionable for human consumption, less is known about their community dynamics.

Extracts from various fruit and plants are known to contain candidates for natural food additives with antioxidant and antimicrobial activity [8], and having positive effects on colour.

Recently, researchers from the University of Aarhus in Denmark and Danish Meat Research Institute proposed the use of herbs and berries in organic meat products, starting from the fact that some berries, leaves, bulbs, roots, and stems of some plants are known for their content in substances with antibacterial and antiviral properties. In some plants, the concentration of these compounds is so high that they can probably be used to preserve food [9].

The research started with 37 species of plants whose antibacterial properties were tested on *Listeria monocytogenes*, *Salmonella typhimurium* and *Escherichia coli*, the list being finally reduced to eight species with demonstrable conservation capacities: aronia, sage, savory, blackthorn, cranberries, wild garlic, red currant, and horseradish [3,10].

Each of them can be added in various combinations and quantities in meat products for preservation, and in most cases, they add pleasant and desired flavours to the meat products. The researchers also aimed to develop optimal processing and storage methods so that the desired properties are preserved as long as possible after harvesting. It has also been investigated how a homogeneous distribution of preservatives in meat can be obtained if they are to be mixed in powder form into the product which presents a liquid form (suspension) [10,11].

A solution in this sense is the lyophilization of plants or of plant extracts with biological value to obtain high quality products. The original shape of the product is maintained, and by rehydration, a product with an excellent quality can be obtained [12,13]. Moreover, it is an excellent method for preserving a wide variety of heat-sensitive materials, such as proteins, vitamins, essential oils, tannins, antioxidants, pharmaceuticals, tissues, and plasma [14,15].

The aim of this work was to study the addition effect of the lyophilized extract of basil, summer savory and tarragon on the physico-chemical quality indicators and microbiological activity of sausages. The spices chosen for this study were basil (*Ocimum basilicul* L.), summer savory (*Satureja hortensis* L.) and tarragon (*Artemisia dracunculus* L.)